United States
Department of
Agriculture

Forest Service
Equipment
Development
Center

Project Record
8457 1203

5700—Aviation

San Dimas, CA

May 1984

Remote Hook Systems for Helicopters

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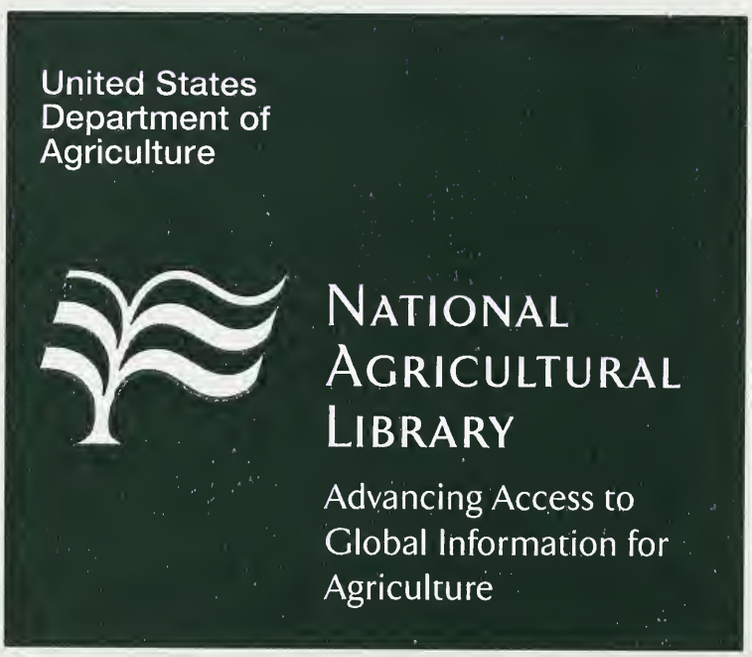

Remote Hook Systems for Helicopters

by

Robin T. Harrison, P.E.—*Aerospace Engineer*
Forest Service
Equipment Development Center
San Dimas, California

5700 Aviation

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May 1984

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INTRODUCTION

Remote hook systems are becoming more and more popular in Forest Service helicopter operations. A special suspension cable is used as a method of placing an electrically releasable hook at the bottom end of the line. This arrangement allows the pilot to drop equipment in tall timber or steep terrain without having to drop the entire leadline with the load, and also allows the retrieval of equipment from such areas. Pacific Southwest Region, South Zone Aviation Unit, has prepared a slide-tape program on the use of remote hook systems. This has been distributed to all Regions, the OAS, and NPS and is now a national training standard.

This Project Record provides users with information on available equipment, a purchasing description, at least one supplier for each component, and instructions on assembly of the components. The equipment described herein conforms to Forest Service Specification 5100-500b. It is the result of considerable experience with long leadline systems in three Regions, after much trial-and-error.

Figure 1 shows a typical remote hook system and guard. The system has three main components—the remote cargo hook, three 50-ft suspension cable sections, and the electrical cable. Assembly of the components is simple and straightforward with no special skills required. Since the entire system is attached to the helicopter via the helicopter's cargo hook, it need not be assembled or inspected by an FAA-licensed mechanic. However, as with all helicopter accessories, scrupulous attention to detail, and a high standard of craftsmanship are required. It cannot be emphasized too strongly that hardware which must be replaced be of the same original quality. All bolts, nuts, pins, etc., must meet AN or NAS standards. All line swages must be done by a properly equipped shop and be proof tested. Anything less will compromise safety.

Figure 1. Typical remote hook system.

CARGO HOOK

All remote hook operations conducted to date by the Forest Service have used the Eastern Rotorcraft (ERC) 2A15E cargo hook—a 1,500-lb working load hook which features both electrical and mechanical release. For remote hook operations, only the electrical release is used. Since the capacity of this hook is 1,500 lb, the capacity of the entire system is likewise 1,500 lb, even though the strength of all other components in the system is far greater than this amount. The ERC hook can be ordered as part of a complete system, or as a component from:

Eastern Rotorcraft
Route 313
Doylestown, PA 18901

Telephone: 215/345-0300

The ERC hook should be ordered with its electrical connector (PC07A 8-1-P), since the connector is not widely available. The hook can be modified by removing the plug which mates with the ERC specified connector and replaced with a 12-in pigtail and a plug of the type discussed below. Appropriate strain relief and potting must be provided. This operation should be carried out only by a qualified radio technician. ERC will soon offer their hook with a 12-in pigtail, which will allow for direct connection to the appropriate plug.

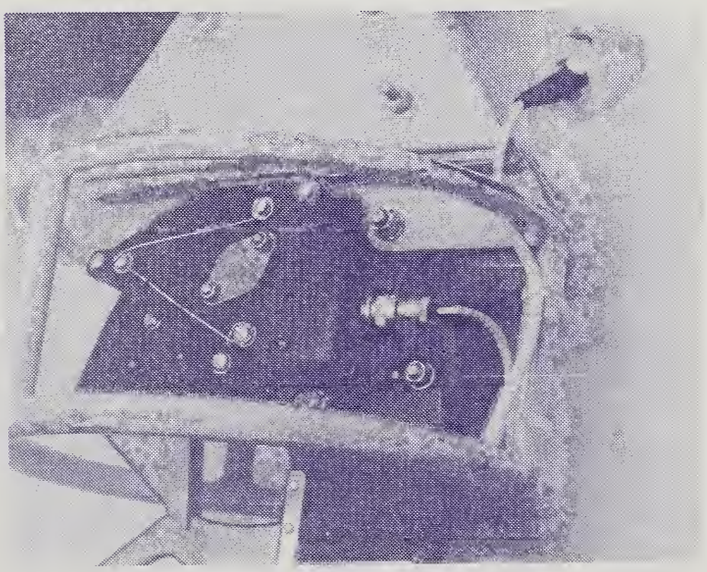

Figure 2. Cargo hook with pigtail made up of ERC connector.

Polarity of the release electrical system is not important; either wire may be connected to the positive side of the helicopter's auxiliary electrical system. Figure 2 shows a cargo hook with appropriate electrical wiring (14-gage, multi-strand) using the ERC supplied plug.

HOOK GUARD

The most successful of several prototype hook guards which we have seen is shown in figure 3. This guard has been pull-tested and found to have a safety factor of at least 5 with a 1,500-lb load. The guard's function is to keep the cargo hook from being damaged when it is lowered to the ground. The guard also provides convenient handholds for the crew-member who attaches the load to the cargo hook. This guard and hook weigh about 15 lb and may be ordered separately, or as part of a complete system, from:

RN Marketing	*or*	Cableco, Inc.
P. O. Box 2203		4333 Maywood Ave.
Tucson, AZ 85702		Los Angeles, CA 90058
Telephone 602/790-5034		*Telephone 213/583-8671*

The San Dimas Equipment Development Center (SDEDC) can provide construction drawings for a similar guard.

Some operators feel that the 15-lb weight of this type guard is not sufficient to cause the guard and leadline to hang directly down during unloaded flight operations. Approximately 25 lb of lead plate can be attached to the guard to increase its "empty weight." This method is suggested for use if additional weight is desired, rather than the use of a "headache ball." Any commercial lead plate is satisfactory.

Figure 3. RN guard.

SUSPENSION CABLE SECTIONS

Suspension cable sections have traditionally been fabricated from 3/8-in, 7 x 19 galvanized aircraft cable, which provides an adequate margin of safety when new, but if used uncoated, is susceptible to abrasion and kinking. Field experience using a new cable, Dyform-18 wire rope, has shown that this cable has 25 percent greater strength than 7 x 19 cable, and is not susceptible to abrasion, rotation, or kinking. Dyform-18 is widely available at cable supply houses and is manufactured by:

Bridon American Corporation
Hanover Industrial Estate
P. O. Box 6000
Wilkes-Barre, PA 18773

Both coated and uncoated cables have been used for suspension cable sections, and each has its advantages and disadvantages. The main disadvantage of plastic coating on the cable is that inspection for broken strands is more difficult than with bare cable. However, with the high cable safety factors provided by using a 1,500-lb hook, particularly with Dyform-18, the chances of broken strands from any cause other than abrasion or kinking are extremely remote. Also, some operators have reported corrosion of the cable, under the plastic, if the coating was damaged. An inferior plastic coating becomes brittle and opaque with age, and cracks and breaks off. Balanced against this, clear day-glow orange plastic coating properly applied to the cable provides the following advantages:

- Improved visibility,
- Greatly improved resistance to kinking, abrasion, and birdcaging,
- Greatly improved resistance to damage from corrosion and rust,
- Greatly improved retention of the original internal cable lubricant, and
- Much improved ease of handling.

If plastic coating is not ordered, galvanized-before-wound cable must be used. Dyform-18 is available galvanized from larger suppliers of wire rope products.

Several types of end hardware have been tried. A forged pear link has been found to be optimum for load release, light weight, and strength. Any adequately load-rated link, round or oval, with a minimum inside longest dimension of

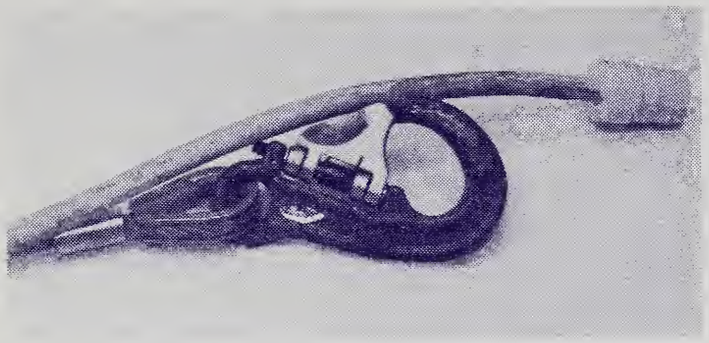

Figure 4. Gunnebo eye hook.

5-in and a stock diameter of 5/8-in or less is satisfactory. A much improved eye hook, made by Gunnebo, and available through many wire rope suppliers, has significantly improved strength and safety features compared with latch type hooks. This hook is shown in figure 4.

The Gunnebo hook will bear its rated working load of 4,100 lb in any direction without compromise in safety factor. This is truly a safety hook; the latch maintains complete strength integrity, and is not merely a device to prevent the ring from popping out as are most latch hook designs. However, any forged latch hook meeting the provisions of Forest Service Specification 5100-500b may be used.

Suspension cables should be procured to the following specification:

Suspension Cable Sections: The sections shall be of 50-ft working length, i.e., 50 ft ±1 in from the inside loaded surface of the hook to the inside loaded surface of the link. They shall be constructed of 3/8-in diameter wire rope. The user shall specify between Bridon-American Dyform-18, or 9 x 17 counterwound antirotating cable. The user shall specify galvanized coating before winding, or coated to 1/32-in minimum depth, polyvinyl chloride, ultraviolet stablized, clear Dayglo Orange. Extra heavy thimbles only shall be used. Ends shall be swaged using stainless or carbon steel or copper swages. NO ALUMINUM SWAGES. Swages shall be painted for slippage check; swages shall not be covered. Users shall specify to one end, permanently attach Gunnebo SKD 05401 keeper hook or snap-type safety hook as specified in figure 2 of Forest Service Specification 5100-500b. To the other end, permanently attach pear link per figure 2 of Forest Service Specification 5100-500b. Proof test each leadline to three times the working load of the cargo hook with which the system is to be used. Permanently tag safe working load and proof test load.

One supplier who has consistently supplied high-quality cable sections is Cableco, Inc., whose address is provided elsewhere in this Project Record.

Some helicopter operators have suggested using nonmetallic suspension cables, and some operators, including the Army, have used leadlines (with nets, etc., not as part of a remote hook system) made of polypropylene rope, tubular nylon, or other nonmetallic material. Limited tests of a Gunnebo nonmetallic leadline at SDEDC indicate that, because of the elasticity of these lines, a very real danger exists with their use. If the remote hook is inadvertently released with a load on the line, the hook can "snap back" into the belly of the helicopter. Should the line break, say, just above the remote hook, the line could "stream back" into the tail rotor. Nonmetallic lines should not be used as suspension cables. This comment does not apply to their suitability as chokers or slings. In fact, no leadline of over 12-ft length should be made of any material other than steel.

ELECTRICAL LEADS

The electrical lead which operates the remote cargo hook should be 50 ft 2 in, + 1, — 0 in to allow extra length for wrapping around the leadline cable. This can be fabricated locally. The plugs should be of the twist lock (NEMA L5-15) type. The male plug goes on the upper end of the line (and on the pigtail coming from the cargo hook), and the female receptacle on the lower end of the line. It will be necessary to fabricate an electrical lead converter to get from the standard three-prong (NEMA 5-15) plug on the helicopter to the upper end of the leadline electrical cable. In any event, the helicopter end, that is, the end of the electrical lead or cable which has electrical power to it, should have the female receptacle. Local purchase of components is suggested. No suitable components are available through the Federal Supply System. Nylon body, high-visibility yellow or white UL listed plugs and receptacles are suggested. It is mandatory that adequate strain relief to the cord be provided and that electrical capacity of at least 15 amps be provided.

The wire used to fabricate the cable should be 14-gage, two- or three conductor, rubber or neoprene jacketed, power cord such as is commonly used for power tools. It too should be procured locally. UL-approved, type SJ, 300 V two-strand copper conductor, rubber jacketed, 60 °C, wire is preferred. However, three-conductor is more easily obtained. The third conductor is redundant.

In no event should ordinary indoor two-strand lamp cord be used because of its inferior resistance to abrasion. Be sure

that the wire selected is compatible with the plugs. The strain relief feature of the plug must clamp firmly to the wire.

The electrical cord should be attached to the suspension cable section using plastic cable ties (tie wraps) with a minimum breaking strength of 30 lb. Electrical cord should be anchored with two tie wraps at each end and one tie wrap every foot. The cord should be wrapped around the cable section once every 10 ft, i.e., the cord should make five wraps of the cable section in a 50-ft length. This wrapping will make rolling the section-electrical cord assembly into a 2-ft diameter bundle an easier task. The tie wraps should be snugged up tight and trimmed carefully to avoid sharp edges. Cut the tie wrap at right angles to its length with a sharp knife. Do not snip it at an angle with diagonal cutters or scissors. The sharp ends left can easily cut the hands deeply. Another method to avoid sharp edges is to singe the sharp ends with a hot soldering iron.

SUMMARY

The suggestions contained herein result from several operators field experience as well as careful engineering consideration. Forest Service Specification 5100-500b—Accessories, External Loading, Helicopter—covers the requirements for remote hook systems. All components purchased should conform to this Specification. Complete remote hook systems may be purchased from Cableco, Inc., or RN Marketing, whose addresses are provided within this Project Record. SDEDC would be very interested in your comments and particularly your operational experience with remote hook systems fabricated as proposed.